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ABSTRACT

Web Based Distance Learning (WBDL) is a form of distance learning based on providing instruction mainly on the World Wide Web. This paradigm has limitations, especially the lack of interactivity inherent in the Web. The purpose of this paper is to discuss some of the technologies the authors have used in their courses at Florida Atlantic University to overcome this lack of interactivity on the Web. The paper describes how technologies including Java/JavaScript, ActiveX/VBScript, a Web-based bulletin board, and Web Chat can make WBDL courses more interactive. (Contains 19 references.) (Author/AEF)

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Adding Interactivity to Web Based Distance Learning

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Abstract: Web Based Distance Learning (WBDL) is a form of distance learning based on providing instruction mainly on the World Wide Web. In developing several WBDL courses, the authors have learned much about the limitations of this paradigm, especially the lack of interactivity inherent in the Web. The purpose of this paper is to discuss some of the technologies we have used in our courses to overcome this lack of interactivity on the Web. The paper describes how technologies including Java/JavaScript, ActiveX/VBScript, a Web based bulletin board, and Web Chat can make WBDL courses more interactive.

Introduction

Social, economic, demographic, and technological changes are challenging higher education to reexamine the way education is delivered (Daniel, 1997). As a result, many American colleges and universities have begun to offer distance education courses and degrees as a way to improve access to educational opportunities for learners of all ages, at all levels, and in diverse environments (L. Parker & A. Parker, 1996). One model of providing instruction that is becoming increasingly popular is to provide instruction mainly over the World Wide Web. The authors of this paper have developed several courses using this paradigm, which we call Web Based Distance Learning (WBDL). In the process we have seen first hand some of the limitations of this paradigm and have developed several strategies to overcome these limits. The purpose of this paper is to share our experience in developing WBDL courses and to present an overview of some of the technologies available to make the Web more interactive. We believe that the Internet has the potential to be more than a compendium of information. When properly structured, Web pages can guide users through a series of instructional activities that present information, direct practice, and provide opportunity for responses.

Requiring Active Involvement

Educators generally agree that for learning to take place, the learner must actively process and make sense of available information. An active learner will integrate new knowledge more readily than a passive learner. Expert teachers are able to use many techniques to ensure the active involvement of students.
For example, classroom teachers rely on a number of visual cues from their students to enhance their delivery of instructional content. A quick glance, for example, reveals who is attentively taking notes, thinking about the lecture or a difficult concept, or trying to make a comment. The frustrated, confused, tired, or bored student is also evident via visual cues. When teaching in the classroom, you can receive and analyze these visual cues and adjusts the course delivery to meet the needs of the class during any particular lesson (Willis, 1993). In contrast, the distant teacher has no visual cues. Those cues that do exist are filtered through technological devices such as video monitors, and most are represented in e-mail type responses. It is difficult to carry on a stimulating teacher-class discussion when technical requirements and distance alter spontaneity.

Without the use of a real-time visual medium such as a television, the teacher receives no visual information from the distant sites. The teacher might never really know, for example, if students are asleep, talking

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among themselves, or even in the room. Separation by distance also affects the general rapport of the class. Living in different communities, geographic regions, or even states deprives the teacher and students of a common community link. For all these reason, it becomes more challenging to require active learning in a Web based course.

One way to increase the possibility that learners actively process information is to require them to develop artifacts of their learning. Dodge (1995) summarizes eight specific strategies based on work by Marzano (1992) that can be assigned to ensure that learners produce knowledge artifacts. These strategies include requiring learners to compare, classify, induce, deduce, analyze errors, construct support, make abstractions, or analyze perspectives that they encounter while using the Web. From our perspective effective teaching via WBDL is more the result of preparation than innovation. The distance educator must employ a number of strategies focusing on planning, student understanding, interaction, and teaching to ensure a successfully delivered course. It is the strategy of interaction that we address in this presentation.

The challenges posed by distance teaching are countered by opportunities to reach a wider student audience; to meet the needs of students who are unable to attend on-campus classes; to involve outside speakers who would otherwise be unavailable; and to link students from different social, cultural, economic, and experiential backgrounds. Many teachers feel the opportunities offered by distance education outweigh the obstacles. In fact, instructors often comment that the focused preparation required by distance teaching improves their overall teaching ability and empathy for their students.

The major shortcoming of using a Web page to teach is the fact that the Web was designed to be an information dissemination technology. Web pages, by their nature, are not interactive. It might be useful to explain exactly what we mean by interactivity. First, we mean that Web pages themselves need to become more interactive. This type of by interaction is the ability of a computer program (or Web page) to modify itself based on user input. Much of the computer-assisted instruction in the first decade of the microcomputer revolution was criticized because they lacked this sort of interaction. The were essentially "electronic page turners." We concede that the non-linear, hyperlink interface of the Web is superior to page turning. However, the language used to develop Web pages, the HyperText Markup Language (HTML), lack the ability to perform simple functions like asking the user a question and providing feedback. To help overcome this lack of interactivity in HTML, both Java/JavaScript) and ActiveX/VBScript) can be used. An overview of each technology is provided below.

Second, we are also interested in other technologies that can make WBDL courses more interactive, both synchronously and asynchronously. The last section of the paper presents some specific tools we have used for asynchronous (a Web based bulletin board or conference) and synchronous communication (Internet Chat).

Technologies for Making Web Pages Interactive

In attempting to make Web pages more interactive, we have explored and implemented many alternative technologies. In this section we present an overview of some of these Java/ JavaScript and ActiveX/VBScript, two technologies designed to increase interactivity on the Web.

Java/JavaScript

Java and JavaScript are object-oriented programming languages that have taken the Internet by storm. Java's popularity lies in its purported ability to work across platforms. While we recognize that Java and JavaScript are quite different, they both provide the ability to make Web pages interact with the user. The Internet no longer need remain a static vehicle and becomes a truly interactive tool for the user. It is here that we find its major value for the educator.

As noted above, both Java and JavaScript are object-oriented. This means that you can create a variety of different types of objects and place them on your Web page. The actions these objects perform depend on the characteristics and behavior of object. Java applets (programs that run in a Web environment) and JavaScript

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scripts (programs written on the Web page) can be used to determine the actions of interactive elements like check boxes, text boxes, buttons, and like objects.

One of Java's great advantages is its inherent security. Because it was created to run applications over the Internet, its designers were very concerned about security. They had to be careful to make it impossible for malicious programmers to build Java applets that could reach over the Internet into users' machines to steal passwords, shut down systems, or perform other unfortunate hacks. To guard against this, Sun developed the "Java sandbox," (referred to as a virtual machine) inside which Java applets are forced to run. This virtual machine blocks all access to potential danger zones on your computer, such as the hard disk and serial ports. While the sandbox makes Java very safe, it also makes Java work slower and somewhat less efficiently than native applications that run directly on your machine without any intermediary processing. (Rowley, 1995, http)

One major problem with Java and JavaScript is that they are based on the computer programming language C++, one of the more difficult languages. Educators building their own Web sites are generally not programming gurus and not Java programmers. In fact, very few Web sites are actually built by professional programmers. That's why programs like Lotus BeanMachine® and Hot Potato® (discussed below) are important: They bring the power of Java to non-programming Web-builders like teachers and their students.

Half-Baked Software is the "nom-de-plume" of the Research and Development team lead by Martin Holmes, at the University of Victoria Computer-Aided Language Laboratory (http://web.uvic.ca/hrd/halfbaked/). One of the programs provided for free on their Web site, **Hot Potatoes**, is an excellent way to quickly create interactive teaching exercises using a combination of HTML and JavaScript. The Hot Potatoes suite is a set of five authoring tools, which enable you to create interactive Web-based exercises of five basic types. The tools include a multiple choice test generator, a JCloze procedure instrument, a crossword creation program, and a short answer test generator. The tools use JavaScript for interactivity, and will work in Netscape Navigator and Internet Explorer versions 3 and above on both Windows and Macintosh platforms. The results can be used for a standalone machine, a network, a CD-ROM, or the Internet. Hot Potatoes comes with good documentation and tutorials, and the easy-to-use, fill-in-the-blanks interface means you don't need to know any HTML or JavaScript coding to create your exercises.

ActiveX/VBScript

ActiveX is Microsoft's approach to adding interactive elements to the Web. ActiveX has the ability to activate the Web by providing the ability to imbed animation, multi-media, and even entire applications directly onto Web pages (Turlington, p.1). Because of ActiveX, the Web need no longer remain static (Ernst, pax02.htm).

One advantage of ActiveX is that it is based on existing Microsoft technologies. Microsoft's strategy for adding interactivity to the Web is to provide the means for embedding computer applications (programs) on Web pages. Microsoft had already developed technologies for linking information in one application (say a spreadsheet) into another (like a word processor). The technology, called **dynamic data exchange (DDE)**, was improved to allow entire applications to be embedded as an object in other applications. This improvement in DDE, known as **object linking and embedding (OLE)**, allowed the creation of compound documents (Chappell, p. 2). ActiveX is an extension of this technology.

The most important components of ActiveX are called **controls** and **containers**. Controls are ActiveX components that can be shared by many programs (containers). Examples of controls include buttons, combination boxes, menus, icons, and so forth. The term *containers* refer to any application that accepts ActiveX controls. These applications include Microsoft Word, Visual Basic, C++, Excel, Access, and others (Williams, p. 14). It also includes ActiveX aware browsers like the Microsoft Internet Explorer (or Netscape with the NCompass plug-in).

Microsoft has provided a simple, easy to use application that enables one to easily create new controls. This application, which works like Visual Basic, is called the ActiveX Control Pad (Lemay, L., p. 4, 5). The

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interface of this program is intuitive and quite similar to the Visual Basic interface. You simply create controls by selecting them from a toolbox. You then set their properties from a properties window and attach any code (or script) to the object. Of course, the scripts are written in the familiar Basic language. You can also develop ActiveX components using Microsoft's Visual Basic.

In many ways, ActiveX technology provides many advantages to Java including speed and ease of development. However, as noted above, Java is much more popular. The major reason for this is the security concerns noted above. Web developers should be aware, however, that there are no security problem caused by adding ActiveX controls to their pages. The problem can only occur when you browse to site with a mischievous application embedded on its page.

Other Interactive Technologies

In addition to using both Java and ActiveX elements to enhance the interactivity of course Web pages, we have also explored other technologies to add interactivity to the class itself. The rest of the paper describes of an electronic bulletin board useful in holding class discussions and the use of live, synchronous chat. The program we used as the electronic bulletin board, WebBoard (O'Rielly, 1997) is described below.

The WebBoard

In our earlier Web Based Distance Learning courses, we used a listserve as a means of holding class discussions. While this was a useful technology, there were several shortcomings. First and foremost, we found ourselves at the mercy of our Academic Computing department. We found it difficult to set up the list the way we wanted it. For example, our AC department could see no reason to allow archiving of messages. This means that if a student joined the list late, there was no means of finding out what had been discussed in the passed. Another shortcoming of listserves is that the messages are not threaded. That is, they are not organized by topic. In a typical WBDL course, several topics are being discussed simultaneously, and it can be quite confusing trying to determine what comments went with which threads.

To solve this problem, we are currently using the WebBoard developed by O'Rielly (1997). This server essentially acts as a front end to a Microsoft Access® database that keeps track of all messages posted. It organized the messages by topic, making it easy to follow a particular thread. The WebBoard also provides many useful administrative tools including keeping track of every time the Board is accessed. This makes it easy to see exactly how often each student contributed to the discussion.

One disadvantage of electronic conferencing on the WebBoard is the fact that all of the discussions are asynchronous. While there are great advantages to this approach, it does not allow for the free exchange of ideas that actively involves students in class discussions. To overcome this, we have used the Chat facilities of the WebBoard, to have synchronous, on-line discussions. The final section of the paper describes our experience in using this and other Internet Chat technologies.

Chat

Internet Relay Chat (IRC) or Chat conferencing systems allow for a group-based interaction using text. IRC allows "real time" electronic conversations between hundreds of users. IRC has different channels and each channel contains a separate conversation. You can move from channel to channel, and you can send messages to "page" people who are on other channels. (Kroll, 1992) Every IRC and maintained by a channel operator who controls the channel. The operator may make the channel private, remove users or shut down the channel. If you want to set up an IRC chat server you need access to an IRC chat server. The authors have access to an IRC server operated by the University Academic Computing Department. The program is the Webmaster Conference Room IRC Chat Server (http://www.webmaster.com/). FAU runs the IRC Chat Server Personal Edition version 1.3.
If you just want to get your own chat room, ParaChat (http://www.parachat.com) offers a free ParaChat Personal license. The Personal License provides a chat room that carries advertisement panels for ads. You can pick a topic and room name but no room administration (ban, set topics, web tours, open/close the room etc.) is possible. This is a good way to get a simple chat room.

Using a Chat Room

The authors establish a time via the course Listserve or WebBoard for the class or a designated group to login to the chat room. We experience better group participation when we have a defined topic or problem to discuss. Posting a topic for discussion on the listserve or WebBoard allows students to have materials and or ideas prepared for the chat session. Posting a schedule of times that the professor will be available in the chat room also provides considerable opportunity to interact with the students. Students enrolled in virtual learning communities can also collaborate using the course chat room. We suggest having a limit of 8 to 10 students in the chat room at one time as that facilitates the interaction and provides a better opportunity for all to participate. It takes the students a brief introductory time to adjust to the "rhythm" or chat timing due to the slight delay. Chat allows students to interact with one another and the instructor synchronously at times that are convenient for all.

Conclusion

While our experience has shown us that Web Based Learning classes present significant challenges to the professional who decides to implement this version of distance learning, there can be no doubt that this paradigm is becoming increasingly more popular. In this paper, we provided an overview of some of the various technologies available to meet these challenges. While true interactivity based on two way video cannot be supported by the current Web, we believe that these technologies can enhance the learning experience by adding interactivity to Web pages.

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